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The MONTHLY REVIEW

Published by the

American Electro-Platers' Society

A SOCIETY FOR THE ADVANCEMENT OF THE SCIENCE OF ELECTRO-PLATING

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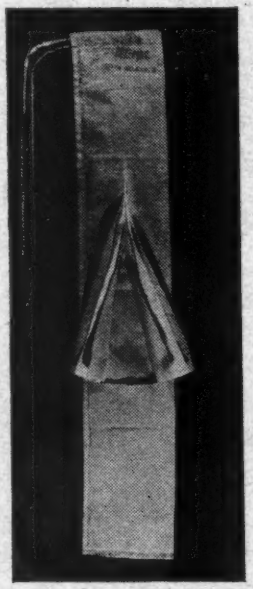

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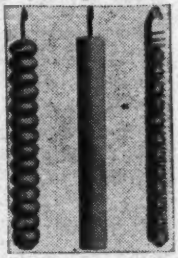

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The MONTHLY REVIEW

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AMERICAN ELECTRO-PLATERS' SOCIETY

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A Genuine Service to the Electro-Plating Industry

WE are living in a period when history is being made all over the world and the delegates to the Twenty-Third Annual Convention contributed their share when they passed the following amendment to our Constitution: "Assistant foreman platers shall be admitted as associate members when they can qualify with five (5) years experience in plating, one (1) year of which they have acted as assistant foremen; provided such an application is presented or endorsed by the foreman plater under whom the assistant foreman is employed. Such an associate member shall automatically become an active member when he becomes a foreman plater."

We, who are members of the A.E.S. realize that membership in this organization is of more worth today, measured in real tangible values than ever before, for the ridiculously low dues of fifty cents per month you have the priceless cooperation and fraternity of the leading executives and technical men in the electroplating industry, who are ready and do share their knowledge with you, thereby making your job easier and your services more valuable to your employer. Realizing that you, as members are getting this service at such a low cost, are you willing to give some of your time and effort to the upbuilding of the A.E.S. and your local branch and place these benefits at the disposal of those who may be eligible to membership?

Believing that past President Hanlon was correct when at the Third Business Session of the Twenty-third Annual Convention, he suggested that we avail ourselves of the wisdom and knowledge of the sixty-three delegates who attended the convention, I hereby appoint them and all other delegates selected by the various branches, as members of the membership com-

mittee with our 1st Vice-President, Mr. Joseph Underwood, as chairman. I also request all those branches who were unable to elect three delegates for the Bridgeport Convention and are omitted below to select three members to serve on the membership committee and notify the chairman accordingly.

DELEGATES AND MEMBERS OF MEMBERSHIP COMMITTEE

Chairman JOSEPH UNDERWOOD

Anderson	George Cole Guy M. Cole John Taylor	*Dayton*	Walter Fraine C. M. Van Derau F. J. McCready
Balto-Washington	T. F. Slattery F. F. Pierdom G. L. Mezzanotte	*Detroit*	A. B. Wilson T. C. Eichstaedt A. G. Spencer
Boston	C. F. Campbell Donald Wood H. J. Lack	*Hartford*	W.J.R.Kennedy J. St. Pierre V. E. Grant
Bridgeport	R. J. O'Connor Joseph Sexton Joseph Downs	*Milwaukee*	R. Steurnagel David Wittig P. J. Sheehan
Chicago	H. A. Gilbertson F. J. Hanlon O. E. Servis	*Newark*	Horace Smith Philip Sievering Nelson Sievering
Cleveland	J. C. Singler Fred Matts E. Steen Thompson	*New York*	F. J. MacStoker C. H. Proctor Philip Morningstar
Philadelphia	Joseph Underwood George Gehling George Long	*Toledo*	James Nagle Philip Hale Walter Weiker
Pittsburgh	Herman Peter S. E. Hedden John Corbit	*St. Louis*	P. E. Miller H. Beshey John Vogt
Rochester	S. P. Gartland C. H. Burnett F. J. Kohlmeris	*Waterbury*	W. F. Guilfoile W. J. Gray Joseph McComas

I would like to have these delegates divide their membership into three groups and each delegate to take the leadership of one group and then a friendly rivalry can in this way be worked out when they report at the monthly meeting on the new members obtained by the respective groups. I will designate the month of December as American Electroplaters' Membership Month.

A prospect for membership list should be started at once in order that when the drive begins it will not be necessary to wait until such a list has been made up before beginning the campaign to enroll new members with qualifications which we insist all our members shall possess. I suggest that our branches secure extra copies of the MONTHLY REVIEW for October and November,

mailing these to prospective members, and I am sure our editor will cooperate in furnishing these at a minimum cost.

Let our aim be during this membership drive to bring before every eligible person in our industry what we are accomplishing in the field of education and research and to personally invite every eligible to join with us and make his lot easier as well as his future more secure.

THOS. F. SLATTERY, *President.*

Annual Report of the Program and Educational Committee

1934-1935

Presented by

T. F. SLATTERY

Chairman

ONE of the undertakings of your Chairman was to provide speakers for some of the branch meetings. We have all realized and seen at a branch meeting, when a speaker is scheduled on the evenings' programs, that a larger number of the members will be present. During August, 1934, I sent the following letter and schedule of branch meetings to sixty manufacturers and individuals:

"Gentlemen:

"As Chairman of the Program and Educational Committee of the American Electro-Platers' Society, I am taking the liberty to address this letter to you in reference to an activity for which the above Committee is soliciting your assistance and cooperation.

"Through the kindness and efforts of you or members of your organization, many of the branch meetings of the American Electro-Platers' Society have been more interesting and educational by the papers or addresses which were presented on technical and practical subjects of interest to the electroplaters. When speakers are scheduled at a branch meeting, many more members are present on that night; therefore, the Committee desires to build up this part of our educational program for the branches with more uniformity and with greater appeal to the individual members.

"It is proposed to secure and list all the speakers possible for this year and to schedule them for the respective branch meetings from October to May inclusive. This list will be published in the MONTHLY REVIEW, but it will not be necessary for the speakers at this time to state the subject of their address. However, it would be desirable that the Chairman of the Educational Committee be notified of the title of the selected papers or address, at least thirty days in advance of the speaker's assigned appearance before the branches. This will permit the MONTHLY REVIEW to carry a notice of the address and the branch societies to send proper notices to their members.

"The Committee desires to thank you for your assistance and cooperation in the past, and requests that the enclosed sheet be filled out and mailed to the Chairman at the earliest possible convenience.

"Very truly yours,
"T. F. Slattery"

The following individuals and manufacturers of plating supplies responded to this, and furnished speakers to several of our branches:

Dr. J. T. Burt Cenans
Mr. M. N. Promisel
Frederick B. Stevens, Incorporated
Norton Company
Oakite Products
American Hard Rubber Company
International Nickel Company
Grasselli Chemical Company
E. I. Dupont DeNemours & Company,
(R. & H. Chemical Department)

Many of our smaller branches commented most favorably on this plan, and I believe that it merits further consideration and enlargement in the future.

Your Chairman, being of the opinion that our MONTHLY REVIEW is one of the best mediums the Society possesses for the dissemination of knowledge and promotion of education amongst our membership, cooperated in every possible manner with our Editor, Mr. W.J.R. Kennedy. A few individuals were requested, and did, furnish articles which were published in the REVIEW. For these papers I desire to thank Mr. Walter Meyer, Dr. Harold Work, and Dr. C.B.F. Young. Six articles on the Principles of Chemistry for Electroplaters were prepared and furnished by Dr. W. Blum. The first lesson appeared in the January issue, and one each succeeding month thereafter. It would be a great help to the incoming Chairman of your Program and Educational Committee if the Branches would comment on these lessons, giving suggestions for improvement and advising of any difficulties experienced with them. In the November issue of the REVIEW the following letter of introduction appeared, which explained a new procedure in the Abstract Section:

"ABSTRACTS OF PAPERS ON ELECTROPLATING

"During the past year the MONTHLY REVIEW has published brief extracts of

papers and patents on electroplating, especially from foreign Journals; most of these were selected by Dr. E. B. Sanigar from chemical abstracts with the permission of that journal. The rest were prepared by Mr. C. T. Thomas and other chemists associated with the Electro-Platers' Society. The Society is especially indebted to Dr. Sanigar for his service in this connection.

"As this was a new venture for the REVIEW, consideration was recently given to the probable value of these abstracts to the electroplaters and to the possibility of increasing this value. The conclusions may be summarized as follows:

"The numerous abstracts on electroplating that appear in Chemical Abstracts and in Metals and Alloys are written chiefly for chemists, many of whom have access to the original journals in case they desire further details.

"These abstracts are also valuable to those platers who have sufficient technical education to utilize the condensed information and who have opportunity to consult some of the original journals. The views of such persons are very well summarized in the letter of appreciation from Mr. Albert Hirsch in the September REVIEW.

"To be of value to the average plater, however, the abstracts (especially of foreign papers) should be written in non-technical language and be sufficiently complete to permit some use of the data and conclusions without referring to the original paper. To prepare the latter type of abstracts requires considerable time, as it is necessary for persons familiar with plating to read and summarize the original articles. In some cases, brief comments by the abstractor may point out the relations of the articles to other papers, or to current practice.

"As such abstracts must usually be fairly long, it would be impracticable to include in the REVIEW abstracts of all papers of possible interest to platers. Instead, an effort will be made to abstract in some detail a smaller number of the most important articles, from the current foreign journals. Brief references will be made to articles in American journals that can readily be consulted by those interested. On this work assistance will be received from E. B. Sanigar; W. R. Meyer; C. T. Thomas; W. Blum; C. Kaspar and others, whose names will be attached to the abstracts they prepare.

"The aim is to render the best possible service to the members of the Society in the space available. After the new policy has been carried out for a few months, further criticism and suggestions will be welcomed.

(signed) "T. F. Slattery, *Chairman*
"Program & Educational
Committee"

The following list of suggestions were sent to those who kindly consented to abstract:

SUGGESTIONS FOR ABSTRACTORS

1. Summarize the article, and especially the conclusions in very simple terms. If necessary, define (in parentheses) any unusual technical terms.

2. If the paper contains any recommended procedure, state it so fully that an experienced person can follow it.
3. Give all concentrations in oz/gal, temperatures in Fahrenheit and current densities in amp/sq. ft.; if it seems desirable, also include the metric and centigrade values.
4. Comment by the abstractor, clearly so indicated, may be helpful to show the relations of the conclusions to those of others, or to present practice. In such comments the abstractor should, however, avoid purely personal views, especially on controversial subjects. Such views can better be expressed in a separate note for publication if the subject warrants.
5. The length of the abstract will depend partly on the importance of the article; but should not exceed one typewritten (double space) page, except for very useful papers.
6. Articles that are reviews or largely theoretical, and contain little new data, usually warrant only a brief abstract to indicate the scope and principal conclusions.
7. Abstracts of articles in readily available American journals such as Metal Industry, Brass World, Metal Cleaning and Finishing, Industrial and Engineering Chemistry, Chemical and Metallurgical Engineering, and Metals and Alloys, should be more concise, and give merely the scope and conclusions.
8. Abstracts should be sent to T. F. Slattery, Bureau of Engraving and Printing, Washington, D. C., by the tenth of each month. If it is possible to send them typewritten, double spaced, with a carbon copy, this will facilitate any minor changes or additions, and will avoid duplication of abstracts.

The technical journals selected and those assigned to abstract from them were as follows:

TENTATIVE SYSTEM

1. *Electrodepositors Tech. Soc.*, E. B. Sanigar
2. *Oberflächentechnik* — W. R. Meyer
   Zeit Elektrochenie — W. R. Meyer

Goldschmudezertung — W. R. Meyer
Die Metallwarm Industrie — W. R. Meyer

3. *Galvano* — C. T. Thomas

4. *Industria Mecannica* — F. D. Rossini

5. *Metal Industry* (London) — W. Blum
Ind. Eng. Chem. — W. Blum
Chem. Met. Eng. — W. Blum
Metals & Alloys — W. Blum

6. *Metal Industry* (New York) — T. F. Slattery
Brass World — T. F. Slattery
Metal Cleaning and Finishing — T. F. Slattery

7. *Iron Age* — E. T. Candee
Steel — E. T. Candee
Metal Cleaning and Finishing — E. T. Candee
Metal Progress — E. T. Candee
Mining and Metallurgy — E. T. Candee
Zeit Metallurgy — E. T. Candee
Trans. A. I. M. E. — E. T. Candee

8. T. F. Slattery will check abstracts each month in Chem. Abstracts, also Metals and Alloys, and refer important articles to available persons, sending a copy of the journal if necessary.

I wish to express my appreciation to these abstractors and also Dr. R. M. Wick and Dr. C. Kaspar, who abstracted for us. I desire to thank and assure the individuals and manufacturers' representatives who spoke before our branch meetings, that these meetings proved more interesting and our members were more enlightened after hearing their well-delivered talks and entering into the discussion which followed. The Society is again greatly indebted to Dr. William Blum for his articles on "Chemistry for Electroplaters", and your Chairman in particular wishes to express his deep gratitude to Dr. Blum for these articles and many other favors and advice given during my period of office.

In concluding, I give my sincere appreciation to branch librarians and others who have cooperated and assisted me during the past three years in the office of Chairman of your Program and Educational Committee. (Applause)

Report of Research Work on **Electrodeposition** *at the National Bureau of Standards*

By WILLIAM BLUM *and* P. W. C. STRAUSSER

Read at the Bridgeport Convention

I. INTRODUCTION

THIS report will be devoted principally to the progress of the researches on electroplating that are being carried on at the Bureau of Standards in cooperation with the American Electro-Platers' Society and the American Society for Testing Materials. Incidental reference will be made to other activities of the section that are of direct interest to the electroplating industry.

The American Electro-Platers' Society, through its Research Committee, has secured the funds for the salary and traveling expenses of P. W. C. Strausser as Research Associate, and during the past few months has also employed C. K. Fewell to assist in the preparation of the specimens for the exposure tests on nonferrous metals. The A.S.T.M. has maintained the facilities required for the exposure tests and has cooperated in the preparation of tests and specifications. Manufacturers of metals and plating supplies have donated the principal materials required. The Bureau of Standards has furnished space, equipment, facilities, supervision and technical assistance. This project is a good example of cordial cooperation.

II. SPECIFICATIONS AND TESTS

During the year several joint committees, of which W. M. Phillips is Chairman, have held conferences on specifications and tests for plated coatings on steel, which will be presented to this convention for consideration. The desire to specify the minimum rather than the average thickness of the coatings, necessitated further study of the methods for determining the local thickness of deposits. One of the methods studied was the dropping method for cadmium, which was proposed by S. G. Clark in England, and was modified by R. O. Hull, who substituted an ammonium

nitrate solution for the iodine solution used by Clark. Experiments at the Bureau of Standards showed that the method could also be adopted to zinc coatings. The results were published in an article by Hull and Strausser in the MONTHLY REVIEW of the American Electro-Platers' Society for March, 1935. It is hoped that this and other methods will be given a thorough trial by chemists and platers, so that the committees can be guided in the designation of approved methods for testing the conformance of samples with the proposed specifications.

Efforts to apply similar methods to determine the local thickness of chromium coatings have not yielded entirely satisfactory results.

III. ORIGINAL EXPOSURE TESTS ON STEEL

The results with nickel and chromium coatings have been published in Research Papers 712 and 724, copies of which were purchased and distributed by the American Electro-Platers' Society. Inspections of the zinc and cadmium coatings have been continued, and as soon as definite conclusions are reached they will be published.

IV. PREPARATION OF SPECIMENS FOR EXPOSURE TESTS OF PLATING ON NON-FERROUS METALS

As the result of conferences and correspondence, a program of the new exposure tests was prepared. An outline of this program was published in the MONTHLY REVIEW for December, 1934. As there indicated, the program will include the preparation of over 6,000 specimens. The base metals consist of cold-rolled and hot-rolled steel; gray and malleable cast iron; rolled copper; cast, extruded and rolled brass; rolled and cast nickel-brass; rolled zinc, and zinc-base die castings. The steel specimens were included to permit comparison of the weather with that during the previous exposure tests. The experience with the former tests facilitated the plating of the new steel specimens, which have been completed.

The inclusion of a large variety of base metals has necessitated some study of the best conditions for cleaning and plating each metal to insure good, adherent deposits. Plated specimens were bent before and after heating, and after standing for some weeks; and if any poor adhesion or blistering was observed, the conditions of preparation and plating were varied until the difficulty was

overcome. In spite of such delays, good progress has been made, and about thirty per cent of the specimens are completed. Unless unusual difficulties are encountered, it is hoped that the plating can be finished and the exposure tests started early in 1936.

V. MISCELLANEOUS ACTIVITIES

C. Kasper has studied the favorable conditions for the rapid deposition of nickel, with special reference to the electrolytic production of printing plates at the Bureau of Engraving and Printing. The results, presented to the Faraday Society and also published in the MONTHLY REVIEW for May, 1935, showed that relatively soft, ductile nickel can be produced in hot nickel sulphate baths with a very low pH, at current densities of over 400 amp/ft^2. Corresponding deposits from chloride solutions are relatively hard and brittle.

A similar investigation is now in progress upon very rapid iron deposition, the results of which will be published as soon as they are available. Both of these researches gave opportunities to test predictions based on accepted theories of electrodeposition, and showed certain limitations of such theories.

A paper by C. Kasper is now in press, in which evidence is furnished that chromium is deposited in chromic acid baths directly from the sexavalent state, and not, as often suggested, from intermediate trivalent or bivalent chromium compounds.

R. M. Wick has been engaged in developing special applications of plating for other Government Departments. When this work is completed it is hoped that the results can be published.

M. R. Thompson has devoted most of his time to the testing of plated materials purchased by the Federal Government, and to special plating problems for Government Departments. The results of the testing work were very similar to those reported to the Electro-Platers' Society last year. Recently a minor assistant has been added to the section staff. It is hoped that his services will permit an extension of the research activities.

This spring, W. Blum attended meetings of the Faraday Society and Electrodepositors' Technical Society in England, and visited laboratories and plants there and in France, Germany and Holland. A separate report of this trip will be presented. Great interest was expressed abroad in the activities of the American

Electro-Platers' Society, and especially their work on research and specifications.

VI. FUTURE PLANS

As above indicated, the preparation of the specimens for exposure tests will require a large part of the next fiscal year. As soon as the exposure tests are started, laboratory studies will be made upon methods of testing and specifying plated coatings on non-ferrous metals. The continued cooperation of the American Electro-Platers' Society will facilitate the progress on this program.

Messrs. Kasper and Wick will continue their present activities. If conditions permit an extension of the research work, the most promising and important fields for investigation will be discussed with the Research Committee and other interested persons. (Applause)

CHAIRMAN PHILLIPS: First of all, Dr. Blum, I have a question to ask you. Do you expect Mr. Strausser to answer the questions that are now to be asked about your talk?

DR. BLUM: We shall give him the first chance.

CHAIRMAN PHILLIPS: The meeting is now open for questions and discussion. This is a very big subject in which we are all vitally interested. I do not know of any more important thing that is going on in the whole electromotive industry than this project of ours on non-ferrous metals. The tests on steel were very, very productive. At a later meeting, we shall have a report on the progress made there in a very, very practical way. It has done more to advance the art of electroplating than anything of which I have knowledge. This is just a continuation of it into a field that is more complex. The plating of steel is somewhat simple as compared to the plating of such things as die castings and brass and malleables and the various other things that this covers. We should have some discussion, and I shall throw the meeting open.

DELEGATE PROCTOR: Dr. Blum stated that they experimented with an almost boiling nickel solution of very high density. Of course, presumably when they get a ductile deposit, then they have no nickel hydride down with the nickel. In other words, that nickel deposit must be from hydrogen and the heat from the solution probably overcomes that problem. I remember many times in days gone by when I had solutions that caused me

considerable trouble due to hydrogen. I used to heat up the solutions as hot as I could and let them cool until the next morning and we had considerable difference in the type of deposit we obtained. So it is going to be some problem, perhaps, to use a boiling solution, but if boiling solutions would be the answer to rapid deposits, I think we could take care of the evaporation, if we did not run into any other trouble.

CHAIRMAN PHILLIPS: Who is the next gentleman to offer something? There must be some discussion.

MR. CHARLES FISTON (Belknap Manufacturing Co., Bridgeport, Conn.): This is really the first convention I have ever attended. So far I have enjoyed it very much. The company I am with was very anxious to have me attend this convention, since it is being held in Bridgeport. The conventions formerly were too far away and we anticipated when one was held in Bridgeport that I could attend. Now that it is in Bridgeport I am very glad to meet all of you.

The question I should like to ask is this: We are now in the manufacturing of brass faucets. I copper plate them, first, and then after a flash copper, I nickel plate them. The thing I am looking forward to is to find out if it is correct to have a soft nickel on there that will take the chromium plate, or should it be a nickel solution that contains a brightener, which they tell me will not hold the chromium. Is that right? That is my question. I should like to find that out.

CHAIRMAN PHILLIPS: First of all, Mr. Fiston, I should say the question probably does not have a direct bearing on this particular research. What are the faucets made of?

MR. FISTON: They are brass faucets. We plated them to give them a flash copper and then a soft nickel for about forty-five minutes, which will hold the chromium. That is what I am doing at the present time, but still, some way or other, we have a few that fail us. I do not know why. That is, the chromium peels off on some and it eats right down to the copper flash. What is the cause of that? The work is cleaned with an electrical cleaner and goes through two cleaners; first an electrical cleaner and then another cleaner, and then it is flashed into copper and placed in the nickel solution and run for forty-five minutes. It colors up very nicely on the buffing wheel in the buffing room and the nickel does not leave at all. It does not raise up. But still the man

who chromium plates them in another plant has difficulty in getting them all correct. If you can help me in any way, I should be very pleased.

DELEGATE PROCTOR: Why copper plate on brass?

CHAIRMAN PHILLIPS: What electroplating Branch do you belong to?

MR. FISTON: To be frank with you, I have not belonged to any lately. I used to belong to the Bridgeport Branch. Then things took a sudden turn and business went down and we got our cuts, as you all know, and I could not keep up with the lodge and the Platers' Association as much as I would like to, so I dropped out of the Platers' Association in order to keep up the lodge for the sake of my family in case anything should happen.

CHAIRMAN PHILLIPS: Mr. Fiston, I should suggest that you put your problem up to the local Branch. They will give you assistance. I think that is the best way to handle it.

DELEGATE GARTLAND: I was much interested in Dr. Blum's talk on the rapid deposition of nickel. For some time back I have been running a low pH nickel — 1.5. I do not run it except over a temperature of about 150, but I will say I have had some excellent results. In three years I have not added any nickel whatsoever, outside of what comes from the anodes. It is very ductile and at times we have to put on deposits of forty-thousandths. I might say from my experience it acts the same way that an acid copper bath works, so I know from my experience that you are going to get something when you get that solution up to the boiling point. I do not know just what the metal content is, but the one I run is six ounces of metal to the gallon. I know that you can get on a very soft plate. We have difficult pieces of steel to plate and we do not copper strike them or anything. We just run them through the acid nickel bath, the low pH bath. You will have no trouble with your chromium deposits on it. In fact, if you have any pieces that you want to bend, that require forming, you can plate them and chrome plate them and have your machine operations take place afterward without any failures.

DELEGATE WOOD: I was very much interested in the high current density that Dr. Blum mentioned, because at one time I tried to accomplish high current densities, but at that time we felt we had to use a high pH solution. This material that we were

electroforming was going into vacuum tubes, and we found if hydrogen was present in the metal it would come out after evacuation and give us trouble. So we held to 6.2. The reason I am bringing this up is because we thought chloride was very beneficial. We ran about normal in chloride, about three or four normal total nickel, and we ran eighty to one hundred amperes per square foot, about 160 degrees Fahrenheit. I wonder if you had at the Bureau any experience that would show whether the higher pH might make the observation on the use of chlorides different from that at the low pH?

DR. BLUM: I am interested in this discussion now of the very high current density in nickel deposition, although I may say in advance we did not have in view directly the application of these conditions to what might be called ordinary plating. We had a special problem of depositing a relatively thick coating of nickel in as short a time as possible. So far as the conditions are concerned, we found that under these extreme conditions the presence of even a part chloride had the same effect as if the solution was entirely chloride. Also, we found that we could not go to the extreme current densities that we desired if the pH of the solution was higher. At intermediate points we could, of course, go to 100 or 150 amperes per square foot with a high pH but we did not particularly investigate that range. We were trying to see what we could do at the limit, so it may well be that, as others have pointed out, at the higher pH the presence of chloride is, at least, not necessarily detrimental or does not necessarily make brittle deposits.

DELEGATE WOOD: Dr. Blum, while you are here, there was one other thing that might be interesting in this same connection. We found that even small amounts of ammonium or sodium salts gave us very hard, brittle deposits, whereas if we kept them out entirely we did not have that trouble. Did you use such salts?

DR. BLUM: We agree entirely with that. Under these extreme conditions the sodium or ammonium or potassium salts are all objectionable. The pure nickel salt is better.

CHAIRMAN PHILLIPS: I think, perhaps an observation from the Chair there is in order. Dr. Blum was working on nickel deposition rather than nickel electroplating. However, the things we find out in deposition are very often applicable to electroplating, and vice versa. The two problems are similar and you

can learn things from one or the other and apply them. I think that may be the case in this particular instance.

We have had no particular discussion of the program on the non-ferrous metals. Does anyone have any question on that? Of course, we are trying, through our Committee, to keep you informed at all times, but now is the time to speak up while these things are being done rather than later on.

DR. BLUM: Mr. Phillips, this might be a good time to make an announcement which has a bearing on this. At the close of this meeting, when we are through with the technical program, we shall hold in this room, if possible, or if necessary in another room, a small conference particularly of the committees that are arranging the program and carrying on the work with these exposure tests. We want anyone who is directly interested to feel free to come in. When I say a small conference, it is not with the idea of excluding anybody, but it is simply to get a small enough group so that we can discuss details which would not be of interest to such a large gathering as this. So those who are members of the committees have received notice, and others who are especially interested will be welcome to attend this conference, which we shall hold in this room immediately after adjournment.

DELEGATE GEHLING: I was wondering if Dr. Blum could tell us what progress they made in nickel plating on red brass that contains lead and tin, out of which house hardware is made, so that they would not have to give it a flash coat of copper. That question is debatable quite a lot of times. When they nickel plate on that, the chromium peels it off.

DR. BLUM: Is that a cast or rolled product?

DELEGATE GEHLING: It is cast red brass. It contains tin and lead. You see door handles, and so forth, made out of it. It has been common practice to give that one even coat of copper first before you start to nickel plate it, so that the metals underneath that will not raise the nickel and give the chromium some help in stripping the nickel off.

DR. BLUM: We shall ask Mr. Strausser.

MR. PAUL W. STRAUSSER: We have not as yet come to the point of plating brass castings. In view of what Mr. Gehling said, I anticipate trouble. That will come later on. I am sorry we have no information at this time. Most of the plating has been on strip materials, and we are about to start the casting material in about

six weeks to two months. I am very sorry we do not have any definite information at this time on that point.

CHAIRMAN PHILLIPS: I think that merely illustrates the point that this investigation is going to be very important and probably will give us a lot of information. Both Mr. Gehling's question and the previous one show the need for such a research very clearly. We hope you will have the answer.

DELEGATE WOOD: Would it be in order for me to say something on that problem?

CHAIRMAN PHILLIPS: Yes.

DELEGATE WOOD: I think I had the problem Mr. Gehling refers to, and I fortunately stumbled on a way around it. The particular job I have in mind was some hose couplings which after they were plated had to be shrunk on to the hose itself. It is quite a serious deformation. I think it is as severe a test as chromium plating would have been. I found one thing after another would not clean them satisfactorily. I was putting nickel directly on this. Finally, as a last resort, I tried sodium phosphate alone. It was a small job and it was possible to scrub them so the lack of cleaning which might have otherwise been there was not so bad. In using this trisodium phosphate solution alone and putting nickel directly on, surprising as it may seem, I got satisfactory adhesion. That was the red brass containing both lead and tin, I believe.

MR. HOGABOOM: Mr. Chairman, may I say a word on that? It is well known in metallurgy that lead does not alloy with copper and zinc. You get the crystals and you get in between the grain boundaries and you get your lead that is not alloyed with the copper and zinc, and that is why you get free cutting stock in a leaded alloy. If you did not have lead in it, you would have a shaving that would be long, but if you put lead in the stock, then you get crumbles, and that is why it is so advantageous to have lead for free cutting stock.

We well know that it is very difficult to get good adhesion of nickel directly upon lead, and if we do not get adhesion then when you come to chromium plate, you are apt to lift. Copper, though, adheres very well to a clean lead surface. So, in all probability, the advantage of copper plating is to cover over the lead, so then when you nickel plate, you have an adhesion and then the chromium plate will adhere. It is a metallurgical problem rather than a cleaning problem, in my opinion.

District Court of the United States

DISTRICT OF CONNECTICUT

No. 2284 EQUITY

UNITED CHROMIUM, INCORPORATED,

vs.

GENERAL MOTORS CORPORATION, THE NEW DEPARTURE MANUFACTURING COMPANY, THE BASSICK COMPANY

OPINION
August 8, 1935

UNITED STATES DISTRICT COURT
DISTRICT OF CONNECTICUT

UNITED CHROMIUM, INCORPORATED, *Plaintiff,* v. GENERAL MOTORS CORPORATION, THE NEW DEPARTURE MANUFACTURING COMPANY THE BASSICK COMPANY *Defendants.*	No. 2281 EQUITY

LIVINGSTON GIFFORD, Esq., GEORGE F. SCULL, Esq., GUSTAVE R. THOMPSON, Esq. and NEWTON A. BURGESS, Esq. of New York, N. Y. for plaintiff.

DRURY W. COOPER, Esq., MERRELL E. CLARK, Esq., FRANK E. LIVERANCE, JR., Esq. and HAROLD F. WATSON, Esq. of New York, N. Y. for defendants

THOMAS, D. J.

This is the usual bill in equity charging the defendants with infringement of letters patent No. 1,581,188 issued to Colin G. Fink on April 20, 1926, on an application filed December 19, 1925. The patent is for a "Process of Electro-Depositing Chromium and of Preparing Baths Therefor." By various mesne assignments title to the patent in suit is now vested in the plaintiff.

The proofs show that two of the defendants, viz. The New Departure Manufacturing Company and The Bassick Company have factories within the District of Connecticut, where they had carried on the chromium plating operations which are alleged to infringe the patent in suit. While there is no relationship between these two defendants they have been joined as parties defendant, and have not objected to the joinder, but have defended the case on the merits. It is admitted in the Answer that the third defendant, General Motors Corpora-

tion, owns a majority of the stock of the New Departure Manufacturing Company and controls and directs its business policies. While General Motors Corporation is not a resident of this District, nevertheless, for the purpose of this suit New Departure's factory in Bristol, Connecticut "has been and continues to be a regular and established place of business in the District of Connecticut for the General Motors Corporation" as admitted in Paragraph Four of the joint Answer of the defendants. Therefore, there can be no question but that the acts of New Departure constituting alleged infringements of the patent in suit are really the acts of General Motors. Therefore the same proofs of infringement as to New Departure may be taken as the proofs of infringement as to General Motors. Moreover, the defendant, General Motors Corporation, under its license agreement with the defendant, The Bassick Company, sends its agents into this District to aid and abet the alleged infringement by the defendant, The Bassick Company. It thus appears that General Motors corporation was committing the alleged infringing acts within this District,—is a proper party defendant to these proceedings and is bound by the final decree.

The patent in suit was held valid and infringed by this Court in a suit by this plaintiff against International Silver Company, and is reported in 53 F. (2d) 390. Upon appeal the decree was affirmed by the Circuit Court of Appeals, 60 F. (2d) 913. Claims 4, 6, 10, 13, 16 and 18 were in suit in the International case and the same claims are in suit in the case at bar.

The invention described and claimed in the patent in suit relates to electroplating and more particularly to a process of electro-plating chromium from solutions of chromic acid.

There are two purposes for which chromium may be electro-deposited. One involves what is known as "winning" metal. This means creating metallic chromium which is to be used as such after it has been separated from the surface on which it has been deposited. The other consists of securing to some article a permanent chromium plating. So far as the Fink patent is concerned the electro-deposition of chromium may be for either of these purposes.

The invention claimed by the patentee is an improvement in the art of chromium plating. The literature on the subject dates back many years which fact is set forth by Fink in his specification, page 1, lines 15 to 31 inclusive. Therein the patentee says:

> "For nearly a century there has appeared in the literature considerable matter in respect to chromium plating, and in that literature the use of chromic acid as an electrolyte, as well as the use of various so-called addition agents has been proposed. Notwithstanding these disclosures, a practical and commercially-available process of electroplating chromium has not heretofore been known, nor have any of the attempts to establish the commercial art of electro-depositing chromium ever satisfied the test of actual commercial requirements. What attempts have been made have always given uncertain and unreliable results and have resulted in ultimate failure as a reliable or satisfactory commercial process."

The invention is further described in the specification, page 1, lines 32 to 50 inclusive, in the following manner:

"I pass an electric current (from an anode to a cathode, the latter serving as the object on which the metal is to be deposited) through a suitable chromium-carrying electrolytic solution, in the presence of a catalyst. The catalyst is, as usual, a bystander which does not enter into the electro-chemical decomposition. The chromium-carrying electrolyte which I have found suitable for my process, is a solution of chromic acid, its degree of concentration as regards baths of commercial interest ranging from about 150 grams per litre to saturation.

"The catalytic agent which I use is one having an acid radical which is stable in the bath and which remains stable under the actions which occur in the process when the current is passed through the bath. This catalytic agent is one which performs its action at the cathode."

Among the acid radicals proposed by the patentee is an acid having a sulphate radical which is represented by the chemical symbol SO_4. S stands for sulphur; O for oxygen and the SO_4, is the sulphate radical which is the catalyst of the patent.

The patent discloses and emphasizes five rules essential to a continuous and commercial operation and asserts that the application of these rules transformed the art of small and impractical laboratory experiments into a continuous, practical and commercially successful chromium plating process. After all his experimentation, Fink established the following rules which are set forth in his specification,—

"(1) In preparing the electrolyte all of the stable radicals (e. g. SO_4) must be computed whether originally in the chromic acid, in the catalytic agent, or otherwise entering the bath.

"(2) The amount of stable radicals (catalytic agent) in the bath should approximate 2.5 grams—be not less than one gram, and not exceed 5 grams of sulphate radical per liter of a solution containing 250 grams per liter of chromic acid.

"(3) The quantity of the catalytic agent should be regulated within said limits for continuous operation.

"(4) By adding to or subtracting from the quantity of catalytic agent (stable radicals) already present in the chromic acid solution the necessary amount to bring the total amount up to or down to the given limits.

"(5) For temperatures of 15° C to 40°C the proper film is obtained with current densities from 1/4 to 1 ampere per square inch."

Prior to the discovery of these rules by Professor Fink no commercial plating was successful, but the evidence conclusively shows that if these rules are followed there will then result a practical, reliable and commercially available and successful process of electro-depositing chromium from chromic acid solutions and a reliable and commercially adaptable method of preparing a chromic acid electrolyte. The formulation of these rules was original with the patentee.

The defenses relied upon by the defendants are as follows:

1. Invalidity of the claims in suit because, defendants assert, "two of the four groups of catalysts which those claims purport to cover are admittedly inoperative to produce the intended results."

2. The process described in the patent in suit was practised by others more than two years prior to the date of the application which resulted in the grant of the patent.

3. Non-infringement.

The first defense is based on the admitted fact that neither the phosphate nor the borate radicals mentioned in the Fink patent can be used alone in the bath. However, the proofs show that each has some catalytic effect and that, therefore, they are stable acid radicals which, in the language of the Fink patent "must be computed" as part of "such agents, whether of one kind or another that are actually in the bath." The Fink patent mentions these radicals as "substances which I find available as catalytic agents and which remain stable", and nowhere says that either of them can be used alone. The Fink patent is neither erroneous or misleading as to these two groups. At the most, reference to them is surplusage, since the patent names at least one group of catalysts which undeniably are highly efficient. That is sufficient under the law. In American Sulphite Pulp Co. *v.* Howland Falls Pulp Co., 80 F. 395, Judge Aldrich, speaking for the Circuit Court of Appeals of the First Circuit, said, at page 401:

> "Some of these compositions (named in the patent) stood the test better, made better linings, and did the work more successfully, than others; and as to such as he used, such as he described, and such as those skilled in the art could understand, he is entitled to protection".

In French et al. *v.* Buckeye Iron & Brass Works, 10 F. (2d) 257, Judge Denison speaking for the Circuit Court of Appeals of the sixth Circuit said, page 261:

> "We do not overlook that the specification sets out an additional particular method and advantage which were perhaps impossible of attainment; but that should not prevent due protection for the results which were accomplished".

There is no merit in the first defense.

For the second defense, defendants rely strongly on the so-called Udy defense and the so-called Manhattan defense, neither of which was presented in the International case.

The so-called Udy defense is based upon the activities at Niagara Falls of Marvin J. Udy, a research chemist in the employ of The Union Carbide and Carbon Research Laboratories, a subsidiary of The Union Carbide and Carbon Company.

The proofs show that Udy was directed to develop a process for the "winning" of chromium from materials containing chromium. He began his experimental research with the Sargent article and for a long time used chromium sulphate in his baths. Like other followers of Sargent, he got results at times, but could not rely on them. Nothing resulted that was commercially useful. He found that chromic acid contained sulphate and he used barium to precipitate it out of the chromic acid. He analyzed his baths but now admits that his method of analysis gave wrong results, so that he reached the admittedly erroneous conclusion that he could electrolyze a chromic acid solution which was pure or which, at least, was free of any mineral acids. It is not clear when Udy changed his method of analysis and obtained accurate results.

In the fall of 1923, in the course of some experiments with coated anodes, Udy concluded that chromium sulphate was not necessary and that free sulphuric acid could be used instead. From this he developed a method for chromium plating in which he first treated the chromic acid with barium hydroxide as a precipitant for the sulphuric acid present to produce what he thought of as pure chromic acid. Then he added sulphuric acid.

Udy proposed to maintain such a plating bath by addition of his supposedly pure chromic acid produced by his barium precipitation method; and, in his patent application filed in June 1924, he said that "in this way, the bath may be preserved for months with little or no change in its composition or behavior."

In December 1923, Udy used his new method in a bath for about two weeks, plating some graphite strips to be used in experimental work by another subsidiary of The Union Carbide & Carbon Company. No adjustments were made to the bath while it was in use except water and the supposedly pure chromic acid. Only one analysis was made and that at the start.

All of Udy's work prior to 1926 was experimental. In connection with it, he produced some chromium metal, the primary object of his research. He also plated articles sent to him from time to time "as test pieces in the experimental development of the solution." Udy's first commercial public work in chromium plating was in May 1926 at the Metals Protection plant in Cleveland, where a trial installation was made. This was a month after the Fink patent had issued, a year after Fink's commercial chromium plating operation on a large scale at the Center Street plant in New York City, and three or four months after the still larger Waterbury plant had begun operations.

Shortly after the Fink patent issued in April 1926, Udy's patent application, filed in June 1924, was amended by inserting certain expressions found in the Fink patent and by copying a number of the Fink claims. An interference was declared. While this interference was pending, the company then owning the Fink patent and the Company owning the Udy application consolidated all their respective interests in chromium plating, including the Fink patent and the Udy application, in the present plaintiff. Under the Patent Office rules, the interference could not be continued because of the common ownership of the patent and the application, and it was necessary for the plaintiff to decide the question of priority since the Patent Office Examiner, over the objection of Fink, had held that Udy could make Fink's claims. The matter was placed in the hands of two reputable attorneys. Udy's then patent solicitor wrote to his Washington associate to get an extension of time in the interference because "it is going to require a good deal of work on our part to determine which party is entitled to the patent." About six months after plaintiff became the owner of the patent and application, on the advice of these two attorneys, Udy was asked to file a concession of priority. This he did but under protest. The Udy application was prosecuted further in an effort to get some specific claims but was then abandoned.

Defendants argue that this concession was filed in bad faith, but the circumstances fail to support such a charge. Indeed, it would have been to the plaintiff's advantage to have had a patent issue on the Udy application, if it had disclosed the Fink invention, since thereby the monopoly would have been

extended at least two years or more and there would have been an advantage in Udy's earlier filing date. No rights of the respective inventors were involved since each had assigned his rights. Garfield et al. *v.* Western Electric Co., Inc. et al., 298 F. 659.

The situation here is similar to that in United Shirt & Collar Co. et al. *v.* Beattie et al., 149 F. 736, in which Judge Coxe, speaking for the Circuit Court of Appeals or the Second Circuit, said, page 741:

> "The question is at best as technical abstraction. No rights of rival inventors are involved, as the complainant, the Shirt & Collar Company, was assignee of both Pine and Dormandy, and that company, with full knowledge of the facts, took the patent, in accordance with what appeared to them to be the truth, in the name of Pine. A decision against Pine now will benefit infringers but will be no benefit to Dormandy."

Similarly, in the base at bar, the invention of the patent in suit belonged to the plaintiff no matter which of its two assignors had invented it. The public interest was not involved, unless there was a prolongation of the monopoly, and that is not present here, because of plaintiff's reliance on the Fink patent which had already run for nearly two years when Udy's concession was filed.

Unless it is very clear that plaintiff's counsel made a legal mistake in advising the abandonment of the Udy application, then the Fink patent should not be invalidated. Such a ruling would only benefit infringers and would mean the loss to plaintiff of the fruits of the experimental work of its predecessors in title which resulted in the *commercial* process of chromium plating now so generally used.

While Udy wrote periodical confidential reports of his research, none of them was ever made public, certainly not until long after Fink's large scale operations had been begun. A number of copies of each report was made, of which Udy kept one,—another was kept in the research files at Niagara Falls, and the others were sent to the New York office of his employer. There is no proof that any one ever read any particular one of these reports. Becket, one of Udy's superiors, says he read a good many of the weekly reports generally and even larger number of the monthly reports, but it does not appear that he ever read the particular reports on which defendants rely. Critchett, another superior says that, while he was generally in touch with Udy's work, his knowledge did not extend to actual details. Becket says that "knowledge of the research work which Mr. Udy did was kept within the organization." The abandoned Udy application was a confidential communication and was not a part of the prior art. Vacuum Engineering Co. *v.* Dunn, 209 F. 219; H. Ward Leonard Inc. v. Maxwell Motor Sales Co., 283 F. 62; Walker on Patents, Sec. 82. There is no proof that any one ever saw any of Udy's baths in operation and, even if they did, the nature of the process in use obviously would not be apparent.

Clearly, Udy's writings *per se* have no evidential value to support a defense. They were not publications. Like an application for a patent, they were confidential writings which were kept secret and inaccessible to the public. Udy did not, thereby "add anything to the sum of human knowledge." Leonard *v.* Maxwell, supra.

Even if Udy had invented the process of the Fink patent before Fink, such knowledge and use by Udy, under the circumstances as presented here, would not constitute a legal anticipation of Fink. In order to anticipate, such knowledge and use must have been accessible to the public, whereas all of Udy's knowledge and doings were kept secret.

After referring to the statutory defense that the patentee "was not the original and first inventor or discoverer . . . of the thing patented", the Supreme Court of the United States, in Alexander Milburn Company *v.* Davis-Bournonville Co., 270 U. S. 390, opinion by Mr. Justice Holmes, said at page 400:

> "Taking these words in their natural sense as they would be read by the common man, obviously one is not the first inventor if, as was the case here, somebody else has made a complete and adequate description of the thing claimed before the earliest moment to which the alleged inventor can carry his invention back. But the words cannot be taken quite so simply. In view of the gain to the public that the patent laws mean to secure we assume for purposes of decision that it would have been no bar to Whitford's patent if Clifford had written out his prior description and kept it in his portfolio uncommunicated to anyone."

Also in Charles J. Gayler and Leonard Brown, plaintiffs in error *v.* Benjamin G. Wilder, 51 U. S. 476, the Supreme Court, speaking by Mr. Chief Justice Taney, said at page 496:

> ". . . by knowledge and use the legislature meant knowledge and use existing in a manner accessible to the public."

With reference to the same subject matter, Judge Townsend, in Matheson *v.* Campbell, 69 Fed. 597 said, at page 604:

> "The consideration received from the disclosure of the discovery to the public is the foundation of the right to the monopoly of the patent. As against an original discoverer, the law recognizes no distinction between the lost art, the abandoned experiment, and the secret process. Whether the conception slumbers buried in the ashes of the past, lies inchoate in the brain of the would-be inventor, or is locked in the breast of its creator it cannot afterwards be dug up, developed, or set free, to question the title of the complete creation first brought forth into the world of knowledge, and thus, as the first born, the rightful heir to the patent estate. As against an original inventor, anticipation is not shown by prior use of the invention under conditions which fail to disclose its composition or opera-tion. Such knowledge of the invention should be accessible to the public. In Boyd *v.* Cherry, 50 Fed. 279,283, Judge McCracy says:
>
> 'If the alleged prior use of the process was under such circumstances that the public obtained no knowledge of the mode of its operation, or of the results to be obtained by it, there is no prior use, within the meaning of the patent law. If kept secret by the first inventor until the second has discovered it and given it to the public, the latter will be protected, for it is to him that the public is indebted; it is from him that the public has received value.' 3 Rob. Pat. 152."

In Pyrene Mfg. Co. *v.* Boyce et al., 292 Fed. 480, Judge Woolley, speaking for the Circuit Court of Appeals for the Third Circuit, said at page 485:—

> "In considering the several alleged prior uses set up by the respondent, we do not find that, within the authority of Gayler *v.* Wilder, 10 How. 477, 13 L. Ed. 504, they were 'so far understood and practiced or persisted in as to become an established fact, accessible to the public and contributing definitely to the sum of human knowledge.'"

It appears from the evidence and is clearly shown that all of Udy's writings and doings were, in the language of the decisions above cited, "confidential" and "private communications" and were "kept secret", and were never accessible to the public", and they never "added to the sum of human knowledge." Consequently they do not constitute a defense of prior knowledge and use, nor are they part of the prior art. Defendant, however, cites and relies upon Corona Cord Tire Co. *v.* Dovan Chemical Co., 276 U. S. 358, but as I read the case it is not in conflict with the conclusion here reached. As Mr. Chief Justice Taft said, the invention there could be expressed in one sentence,— "I claim the use of D.P.G. as an accelerator because I was the first person who observed its efficacy for that purpose." The mere statement of this to any one would disclose the entire invention. Kratz, held to be a prior inventor, had tested D.P.G. as an accelerator and this work "was known to and participated in" by Kratz' associate, the chief chemist of his employer, who corroborated Kratz' testimony. Kratz also read a paper on his discovery at the Philadelphia meeting of the American Chemical Society entitled, "The Action of Certain Organic Accelerators in the Vulcanization of Rubber", which was a review of the comparative excellence of a number of well-known and used accelerators. This fact clearly shows that Kratz discovery was not "secret", but was "accessible" to the public. In Brush *v.* Condit, 132 U. S. 39, the prior use was "the public, well known, practical use in ordinary work" of an electric lamp "in the presence of the employees of the factory." In each of the cases of Coffin *v.* Ogden, 18 Wall, 120, Reed *v.* Cutler, 1 Story, 950, 599, Fed. Cas. No. 11,645, and Concrete Mixing and Conveying Co. *v.* R. C. Storrie & Co., 27 F. (2d) 838,840, affirmed 282 U. S. 175, all cited by defendants, the facts indicate that the anticipating prior use was open and accessible to the public and known to many persons. Furthermore, the Udy process, which is described in his abandoned application, does not anticipate the Fink invention nor did Udy practice the Fink invention.

The Fink patent discloses a practical, reliable and *commercially* available method for chromium plating continuously and with certainty. By it, as the Circuit Court of appeals said in the International Silver case, "for the first time the art could turn out chromium plating with certainty", and I add what I regard as important, the further element of *commercial* plating with certainty. It is Professor Stevenson's uncontradicted testimony that the Udy process "would fail commercially". This is true because the Udy process does not take into account the possible presence of acid radical catalysts other than SO_4 and because no additions are made to the bath in continuous operation except water and supposedly pure chromic acid. To obtain this, Udy proposed and used barium hydroxide to precipitate the sulphate in the commercial chromic acid. But this would not remove any other acid radical catalysts in the acid and, even as to the sulphate, the results are admittedly uncertain. Either some barium or some sulphate would remain in the acid. All this would upset Udy's

idea of maintenance of the bath by the mere addition of chromic acid. Nor would such additions take care of bath variations arising from drag-in, drag-out and spray losses.

Therefore, I conclude and find that the Udy process is uncertain, unreliable and not a practical, reliable and commercially available method. It has never been used commercially, and Udy himself in his first public work in 1926 at the Metals Protection plant dropped the barium precipitation step and maintained the bath just as Fink does. His two weeks' operation of a bath in the research laboratory in December 1923, in which no additions were made except of chromic acid and water, was not sufficiently long to show that the Udy process would satisfy actual commercial requirements and was not the practising of the Fink invention.

Defendants assert that plaintiff has wilfully attempted to conceal this so-called Udy defense and because of this ask that all relief be denied. The facts do not support defendants' assertion. None of the steps taken in the Patent Office were unusual. The existence of the Udy abandoned application would be apparent to anyone investigating the Fink file wrapper. No attempt was made to silence Udy even by retaining him in the employ of the Union Carbide & Carbon Company which owns a relatively small part of plaintiff's stock. When he was discharged from that employ, Udy was permitted to carry away with him a full set of his reports, though he had expressed his resentment when he signed his confession of priority.

Udy's experiments and Udy's application did not negative novelty because they did not meet Fink's claims. His experiments did not negative invention, because they never satisfied the requirements of the prior state of the art. His application did not negative invention because it never satisfied the requirements of the prior art, and because the process described by it did not correspond with Fink's either in mode of operation or result.

I, therefore, conclude that the Udy defense is not sufficient to invalidate the Fink patent in suit.

The so-called Manhattan defense is based on the activities of the laboratory workers of The Manhattan Electrical Supply Company at its Jersey City Plant. Late in 1923, they began experimenting with the chromium plating of tools for some experimental work on dry batteries and continued that work in 1926.

The evidence shows that, like the Bureau of Standards, in the language of the Circuit Court of Appeals in the International case, the Manhattan workers "often got good results; it is equally plain that they did not know on what the results depended and could not rely on producing them."

Starting with the Sargent article, the Manhattan workers conceived the idea that the bath should have more trivalent chromium than would be derived from the chromium sulphate of the Sargent article, or, as they expressed it at that time, more trivalent chromium "than is theoretically required to combine with the SO_4 radical present" to form chromium sulphate. They were thinking in terms of chromium sulphate in the bath. They considered the radical, not as the important element to be controlled in relation to the chromic acid in the bath, but merely as the thing by which to measure the relative amount of trivalent chromium in the bath.

Although the Manhattan baths were analyzed at irregular times for chromic acid, trivalent chromium and sulphate, there is nothing in the Manhattan records to indicate that the analysis for sulphate was for any purpose other than as a measure of the amount of trivalent chromium above that which would combine with the sulphate to form chromium sulphate. Many of the analyses show wide departures from the amount specified in the Manhattan "formula" and yet nothing was done to regulate the sulphate content of such baths. In contrast, there were frequent treatments of the bath with methyl alcohol to increase the trivalent chromium content when trouble developed in the plating.

In July 1924, and therefore after Fink's date of invention, additions of chromium sulphate and of sulphuric acid were made to one of the Manhattan baths which had been producing bad plating from the first. Defendants urge this as proof that the Manhattan workers appreciated the importance of the acid radical. But the circumstances surrounding these additions, especially in the light of the subsequent history of this and other baths, contradicts this. When trouble in plating developed, there were repeated treatments of the bath with methyl alcohol and then a series of tests were made to determine what amount of trivalent chromium would give the best results. In these tests the sulphate radical content varied greatly but no attention was paid to that. Instead, the bath was given frequent treatments with methyl alcohol. Then some chromium sulphate was added to the bath and, later, several additions of sulphuric acid. Because of the absence in the laboratory records of the dates when the results of analyses were received, there is no proof that these additions were induced by the results of the analyses and some of them were clearly made independently of analysis. The recollection of the Manhattan workers as to these events, given ten years after the event cannot be relied on, especially since they now have the present day knowledge of the essential thing in chromium plating.

That there was no thought of restoring the sulphate radical to the amount required by the original "formula" is evidenced by the many additions which were made in such a short period and which finally brought the sulphate content up to nearly three times the amount called for by the "formula." Thereafter, no further additions or subtractions were made, though the sulphate content continued greatly in excess of the "formula", sometimes exceeding Fink's limits, as now calculated. Obviously the Manhattan workers were floundering. Such additions of chromium sulphate and sulphuric acid as they made were like their additions of methyl alcohol, just to see what the effect would be, without appreciation of the essential chromic acid—acid radical ratio of the Fink invention or that the radical alone was important.

This conclusion is in accord with what the Manhattan workers did in the first half of 1925, more than a year after their experimenting began. A new bath was made up which gave "dark" plate from the beginning. Yet no analysis was made for five weeks and then the sulphate content was double that of the Manhattan "formula." Three weeks later, without further analysis, chromium sulphate was added at intervals of a few days. At that time, its sulphate content was three times that of the "formula". It is admitted that the additions were made to this bath to "try and see if an increase of chromium sulphate would remedy the trouble." The Manhattan workers, even at that late date,

were thinking in terms of chromium sulphate, and their repeated additions of it, when the sulphate radical content was already double that of their "formula", emphasize the fact that they had not caught the essential idea and were grouping in the dark.

During the period of the Manhattan experimentation, there were other baths, which were made up and which were discarded because, apparently, the Manhattan workers did not know how to correct them. In other baths, the sulphate radical content was allowed to wander haphazardly and often outside Fink's limits, without any attempt to correct it. In still other baths, the sulphate content remained fairly constant, not because of any regulation, but apparently fortuitously.

In these respects, the Manhattan history is like that of the Westinghouse Company. As the Circuit Court of Appeals said in the International case, supra, the Westinghouse Company also had "a number of baths in which the chromic sulphate and radical were within Fink's formula." But in December of 1925, the Westinghouse Company, just like the Manhattan workers, had "baths in which both the chromic sulphate and the radical ran well above his (Fink's) maximum."

On the entire history of the Westinghouse experimentation, the Circuit Court of Appeals concluded that "the proof is too uncertain that they had even established any limits to the ratio in terms of the sulphate; it certainly does not disclose the idea that the radical alone was important." Therefore, it follows that a consideration of the entire history of Manhattan leads to the same conclusion as was reached in the Westinghouse defense.

All of the proofs in the International case as to the alleged prior use by Westinghouse and Eastman have been incorporated in this case by stipulation and nothing has been added to them in this trial. The Circuit Court of Appeals held that these alleged prior uses did not anticipate and it is so held here. Nor do I find anything in the prior art patents or publications which can possibly be held to anticipate the Fink invention. The pertinent ones were discussed and decided by this Court and the Circuit Court of Appeals in the International case and it will serve no useful purpose to rehearse them here. For the reasons herein given these various defenses fail.

The charge of infringement is based on the process used by the defendants New Departure and Bassick at their factories in Bristol and Bridgeport in this District. As pointed out, supra, the defendant General Motors admits that it owns the majority of New Departure stock,—that it controls and directs New Departure's policies in business and that the New Departure plant is a regular and established place of business of General Motors in this district. Under these facts, infringements in this district by its subsidiary, New Departure, are infringements by the defendant General Motors. Industrial Research Corp., General Motors, 29 Fed. (2d) 623; Detroit Motor Appliance Co. *v.* General Motors, 5 Fed. Suppl. 27.

Moreover, General Motors, pursuant to a license agreement with the defendant Bassick, sent its employee to the Bassick plant and in that factory set up and put in operation the first chromium plating bath used by Bassick and instructed the Bassick employees how to carry on the process which Bassick used. Consequently, General Motors is also a contributing infringer in this

District if the Bassick process infringes. There is no material difference between the processes used by Bassick and by New Departure and they will be considered as one and the same thing and as defendants' process.

The plating operations, in defendants' process, are continuous and successful. The article to be plated is the cathode. The bath temperatures, the current density and the free evolution of hydrogen at the cathode are the same as in the process found to infringe in the International case.

Defendants' baths were made up of chromic acid and chromium sulphate. After being made up, they were analyzed and adjusted on the basis of such analyses. In operation, frequent analyses for chromic acid and SO_4, were made and the baths adjusted on the basis of such analyses. In adjusting for the SO_4, sometimes chromium sulphate was used and sometimes sulphuric acid. One of the Bassick employees testified that after the determination of the total sulphates, he added either chromium sulphate or sulphuric acid "to bring up the concentration of total SO_4, to the same proportions as given in the original concentration in the old bath . . . *heed being paid to the difference in sulphate contained in either chromium sulphate or sulphuric acid.*" In all cases, both in the original make-up and in the subsequent adjustments, the ratio of chromic acid to SO_4, was approximately Fink's optimum.

Defendants see to it that the chromic acid they use is as free from other acid radicals as possible. General Motors' specifications for chromium plating chromic acid to be supplied to its subsidiaries limits the "sulphate (SO_4) to .25%" and "chlorine (Cl) none" and the agreed samples typical of that used by defendants come within these limits.

Present day suppliers of commercial chromic acid for chromium plating furnish such acid of very high purity. Defendants' expert admits that it was the use in chromic plating which induced the demand for and the supply of chromic acid free from other acid radicals. In 1928, one of the suppliers of chromic acid stated in its advertisement that "in the light of present knowledge it is quite evident that many of the baffling failures in Chrome plating in the past were due to impurities, some of which need only to be present in minute traces to cause disastrous results." In contrast, prior to the Fink invention, there were instances of so-called "C. P." chromic acid containing 3% or more of SO_4.

Defendants assert that they do not infringe because they are "following Sargent." Since the proofs here, as well as in the International case, show that Sargent's "followers never could depend upon his process" and defendants' process is admittedly dependable, it follows that defendants must be doing something which Sargent did not teach. Clearly it appears that defendants are controlling the acid radical catalysts of the bath as taught by Fink and as Sargent did not teach.

Defendants further assert that their insistence on chromic acid with very low acid radical content is in accord with what a Westinghouse experimenter did and which was referred to by the Circuit Court of Appeals in the International case as showing that this experimenter "had not grasped the critical facts". It is doubtful whether the unsupported testimony of one witness as to the alleged Westinghouse return of impure chromic acid is sufficient proof. This alleged practise certainly did not occur until September 1924,—several months after Fink's date of invention and therefore was not in the prior art.

In any event, the Circuit Court of Appeals in the International case did not distinguish the Fink invention from the Westinghouse experiments merely because of this alleged insistence on having pure chromic acid. If it had, the defendant in the International case would not have been held to be an infringer, because that defendant also specified that "the sulphate content" of its chromic acid "shall not exceed 1/10 of one per cent."

It is clear that defendants, as well as the chromium plating art generally, now know "the critical facts" and therefore use chromic acid as low in other acid radicals as possible, so that additions to the baths will have a minimum disturbing effect on the acid catalyst content.

Defendants also assert that, starting their baths with chromium sulphate, they maintain them by controlling the chromium sulphate and not the SO_4. While they do use chromium sulphate as a bath addition, it is clear that they use it merely as a source of SO_4. That they sometimes use sulphuric acid instead of chromium sulphate shows this. In determining the amount of either chromium sulphate or sulphuric acid to be added, defendants utilize only the SO_4 content of the analyzed bath as compared with its original SO_4 content. While they calculate the amount of chromium sulphate which would contain the amount of SO_4, present in the bath, the witnesses are in agreement that that does not determine the amount of chromium sulphate actually in the bath. Because of the presence of other substances with which the SO_4 might combine, it becomes, as one witness testified "quite a matter of speculation" to assign the SO_4 among these different substances. Defendants' procedure is certainly quite different from that of the early Westinghouse chemist who really was attempting to determine the amount of chromium sulphate in his baths when the Westinghouse experimenters thought their chromium sulphate was the important thing.

Following the teachings of Fink,—and not Sargent, defendants analyse for the acid radical and base all their calculations for adjustment and maintenance on their radicals alone. When they do convert the SO_4 determination into chromium sulphate, they are doing an idle thing and merely speculating as to what might be the chromium sulphate content of the bath. What they really do is to keep "an eye on the radicals in the solution."

It must be held therefore that defendants' process infringes the Fink claims 4, 6, 10, 13, 16 and 18 in suit. For instance, referring to Claim 13, defendants carry on their chromium plating operations by plating on a cathode from a chromic acid solution in the presence of a hydrogen film and use the sulphate radical catalyst in an amount less than 5 grams per liter to 250 grams chromic acid. Referring to Claim 16, defendants analyse the new baths prepared by dissolving commercial chromic acid, and then adjust the baths so that the total amount of catalytic radicals present is less than 5 grams per liter of solution containing 250 grams of chromic acid.

It follows therefore that there may be a decree for the plaintiff adjudging the patent in suit valid and infringed, an injunction, a reference to a master and an accounting of profits and damages. Submit decree accordingly properly consented to as to form.

Hartford, Conn., August 8, 1935.

Our Experience in Cadmium Plating *in a Barrel*

By AUSTIN F. FLETCHER
The Brewer-Tichener Corporation
Binghampton, N. Y.

Read at the Bridgeport Convention

I HAVE not prepared a paper. I found out only yesterday that they needed a paper on barrel cadmium plating.

We have kept track of all our cadmium plating since last March, 1934, and in that time we have plated 21,000,000 pieces of work, which amounts to 390,000 square feet of surface and 379,000 pounds of work. *The idea of this experiment was to find out how much excess cadmium we were using to deposit a required thickness.* In other words, if you had to deposit an average thickness of one ten-thousandths, which we require on these samples, we used a certain percentage of cadmium over and above what you would use if you had an average covering on the pieces.

At the start of this experiment we had no system of plating. We just loaded the barrels and let them run, the same as the rest of the boys do. That was in March of last year. In May I put in an additional tumble cleaner. Before I put in the tumbling cleaning, I was running the free cyanide at about eighteen ounces. That was to take off some of the dirt and we did not clean off at the beginning. We used to soak the work and just dump it into the barrels and let it go. Now we just throw the work in and tumble it in a cleaning solution after soaking, and then put it in an acid dip. The difference in the excess cadmium used by using an additional tumbling cleaning and with the acid dip was reduced from 170 per cent to 130 per cent. That was in two months' time, from May 21 to July 11.

When I saw the forty per cent difference, without having any measurements on any of these pieces, I figured up some of them and some of them were a little bit too deep, so I had one of our draftsmen figure the surface on the rest of them. After we got the square foot surface, we scheduled each piece through the plating barrels at an average time.

All of these pieces up here (indicating samples) were gathered

up around the plant. Probably some of them had laid around a month or a year. These two pieces have an average thickness of two ten-thousandths, and the rest of them have an average thickness of approximately one ten-thousandth.

As soon as I got the square foot surface on all these pieces and scheduled the time through the barrels, it immediately cut the excess cadmium down to between forty-five and fifty-five per cent, July 12 to December 14. At that time I did not know what the barrel efficiency was, so I used a figure that they all seemed to agree upon for a barrel after it has been in use for several years, which will probably give you sixty or seventy per cent, so I used that as a figure and I used the excess cadmium of forty-five to fifty-five per cent. Then I decided that I would find out what the actual barrel efficiency was.

I ran an experiment on barrel efficiency. The barrels were approximately five years old. I have three experiments here in the 42" barrel. One had seventeen square feet and one had fifty-nine square feet and the other one had twenty-three square feet. Each one of those loads was loaded up to the center of the barrel, or over and above the center, or three-quarters full. On that barrel which was five years old, I had a barrel efficiency of 86 per cent, of 86.4 per cent, and 87.9 per cent. That was with the cadmium solution of two ounces of cadmium and eight to ten ounces of free sodium cyanide.

I have two barrels. One is forty-two inches and one is twenty-four inches. The forty-two-inch barrel has 154 gallons of solution and we carry 150 pounds of anodes. The twenty-four-inch barrel has 100 gallons of solution and approximately 100 pounds of anodes. There are negative connections on each end. Panels have three-sixteenth perforations. Barrels make four and one-half revolutions a minute.

On the twenty-four-inch barrel I ran approximately twenty tests, but I have only five of them here. Two of them came to 93.7 per cent efficiency, one was 100, one was 103, and one was 114. We have some other tanks that are on the same generator, and we had a fluctuation of the ammeter, which would give you a different variation in your barrel efficiency.

About six months ago I put new panels in the barrels and decided to try the efficiency with the new barrels, in the meantime

experimenting, that is, by testing the pieces as we went along, with the new barrel. I found that we were depositing more metal than we had been depositing previously, so I have been reducing the cadmium and the free cyanide down the line and I found that I had one and one-half ounces of cadmium and six ounces of cyanide and was getting very good results.

So I ran a barrel efficiency test on both barrels. On the forty-two-inch barrel I ran one load for ninety minutes and one load for sixty minutes, and both of them showed a barrel efficiency of 100 per cent. In the twenty-four-inch barrel, one was run for sixty minutes and one for ninety minutes, and they both showed a barrel efficiency of 98 per cent, although I put a little more free cyanide in and brought it up to 100 percent.

In some of the literature I have been reading they claim that one can take a load and take fifty or sixty square feet and stick it in there and plate it in fifteen minutes if you want an average thickness. I took sixty square feet of this ring and sixty square feet of the pin down here (illustrating). The ring on top loaded the barrel to approximately three-quarters full, and on the barrel efficiency I had 109 per cent. Of course, we had a fluctuation in the ammeter, which would give you a different percentage. On the pin, that is the small piece down there, it came to only about here; in other words, the danglers in the barrel were just about touching it. It dug into the load a little bit and we had a barrel efficiency of thirty-six per cent. When I discovered that, I loaded the barrels to the center of the barrel or over. Of course, a lot of these things are light weight and they take up a lot of space and there is not much surface. When we get into the heavier stuff, the bolts and nuts, and so forth, we just loaded it in there and plated it a longer time.

After I got the 100 per cent efficiency, I found I was running between thirty and forty per cent excess cadmium, and I could not find out where it was going. We sent the ammeter away and had it checked and it came back and I still had the same difficulty. I decided I was losing a whole lot. We wired up twenty-five of these clamps and I had a fellow sit along side of the cadmium tank and dip them in the cadmium tank. We had three or four pails along the line with fresh water in them, and he rinsed them in each tank as he went along and then he had fresh water on the end and he rinsed them off in that. Then he stuck them back in

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the tank. He did that twenty-five times, that is, with twenty-five clamps, which gave us a surface of 250 square feet. This was in the cadmium solution of two ounces of metal and eight ounces of free cyanide. Those 250 square feet of surface dragged out 3.5 ounces of cadmium. (That was not in the barrel; you are going to lose some because it sticks to the barrel), and ten ounces of free cyanide. In other words, I found it was costing me $.001 per square foot for the cadmium and cyanide that was dragged out.

We got a separate tank along side these two barrel platers and every load was sprayed over this tank and thus we saved all that drag-out. We use that as a rinse tank before we go into the cadmium tank. In other words, we started dragging back the drag-out. We immediately went down to about thirty-five per cent, December 17, 1934 to April 5, 1935. Then I decided that the boys were chiseling a little bit and were not watching their ammeters and their time. I told them they would have to keep the time and the amperage accurate at all times. So they went on the job and kept watching it.

From here down, from April 8, 1935, to May 24, which was two weeks ago, these last five weeks have shown an average of sixteen per cent of excess cadmium. If we take the last two weeks on this chart and the last two weeks that I do not have here, it figures up to thirteen per cent excess cadmium. The only way I can account for that is that probably I am losing some of the drag-out which I do not get.

While we were making these other experiments up along in here, I was running the solution at two ounces of cadmium and eight to ten ounces of cyanide. I used 1,529 pounds of cadmium, and I also used 1,045 pounds of sodium cyanide. In other words, for every pound of cadmium I used, I required .683 pounds of sodium cyanide. That was with the old barrel. When I got the 100 per cent efficiency and the solution at one and one-half of cadmium, six ounces of cyanide, I reduced the sodium cyanide required to .497, or a half pound of sodium cyanide required for each pound of cadmium used.

I got away from this drag-out business for a minute. We ran it on these clamps. Then we ran one on bolts and nuts, and went through the same procedure. I found that I got a half ounce more metal and five ounces more of sodium cyanide in the drag-out, and the drag-out on bolts and nuts would be $.0011 per square foot.

At the same time we also made a test on the cleaner we were using. All the work goes through a soak cleaner and then a tumble cleaning operation. We use a lot of cleaner in the tumbling cleaner because the grease comes to the top and as the barrel turns around we let it flow off rather than try to save a little bit. We used 823 pounds of cleaner and cleaned 145,000 square feet of work at a cost of .00056 cents per square foot.

While we have been going along with that, we started to make a test on average thicknesses and the minimum thicknesses. We wanted to find out just how much cadmium we had to put on in excess to get a minimum thickness. Of course, all my stuff is average thickness. I saw these specifications coming up in the Bureau of Standards and I thought I would find out what it was going to cost us for minimum thickness. I have been running some tests to find out.

For thirty-three and one-half square feet of surface in the tank I had 340 amperes on the load. That was when the barrel effi-

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ciency was eighty-six per cent with the solution of two ounces of cadmium and nine ounces of cyanide. I plated that load for seven minutes before we could get a minimum thickness of .00005". I found that I had deposited 108 per cent excess cadmium to get a minimum thickness of .00005". For the .0001" I had used eighty per cent excess cadmium and for the .00015" I used sixty-six per cent.

I loaded the barrel heavier and put in forty-five square feet and I reduced the amperage on the barrel to 250 amperes, and I had the barrel efficiency of 100 per cent and the solution at one and one-half ounces of metal and six ounces of cyanide. I plated the five hundred-thousandths where I got 108 per cent efficiency. I reduced that to sixty-six per cent. On the one ten-thousandth where I had the eighty per cent, I reduced it to forty-eight, and on the one and one-half ten-thousandth, where I had the sixty-six, I reduced it to thirty-seven. I did not run a test on the first one of two ten-thousandths, but on the second one I found I was using an excess cadmium of twenty-nine per cent.

I found I was getting better distribution and I was plating at a lower cost by loading the barrels heavier and lowering the amperage and plating for a longer time rather than to put it on there fast and let it go like that. In other words, I figured if I had ten or twenty thousand or forty thousand pieces in the load and plated for ten or twenty minutes and had four and one-half revolutions, I did not think there was anything in God's country that was going to make those forty thousand pieces all get some plating in twenty minutes. I figured that if I doubled the time and let them come around in the barrel and plate slowly, I would plate at low cost and better distribution.

Some Pertinent Questions Regarding Future Conventions

Several months have elapsed since the American Electro-Plater's Convention was held. Since then most of those who attended this most successful event have had time to give some thought to future meetings of our organization. One of the things in the minds of those who were responsible for the successful carrying on of the exhibits as an added feature of the convention program

is, should we expect a similar display every year? Do we appreciate the amount of time and money spent by our exhibitors or do we realize that exhibits used this year at Bridgeport would not in all probability be displayed next year at Cleveland, all of which means continual expense to those equipment manufacturers and supply house men who are continually called upon to support the Society's Research and advertising program, to say nothing of the local branch affairs, which are run mostly by advertising and which, as a matter of business policy, our good friends just mentioned feel bound to support.

It is true, of course, that many of those who gave unstintingly of their time and effort this year would continue to do so indefinitely, but there are others who are not so strong financially. We wonder if we are not expecting too much of both the large and small manufacturer by placing this added burden upon them when they are so willing to contribute to the other pleas of our organization's activities. We have had no personal complaints from any source regarding all this, neither are we informed as to the tangible results at Bridgeport, but common sense tells us that we are in danger of killing the goose that lays the golden egg. Would it not be enough to limit the display of plating room equipment and supplies to every other year or every four or five years?

Success achieved at Bridgeport might not easily be duplicated in other cities where our conventions are being held. We are not strong enough numerically or financially to follow the example of the foundry men, but we do know that the small tool manufacturers consider a display of their wares every four or five years to be sufficient.

President Slattery will gladly receive an expression of opinion regarding the advisibility of continuing exhibits yearly as a part of the convention program, from all persons interested. The Cleveland Convention Committee is getting busy and should have ample time to make the necessary preparations if it is the concensus of opinion that we are following a safe and sane course in putting on an exhibit as an annual event. The closest cooperation between the Executive Board of the Supreme Society and the Convention Committee is assured. The same enthusiastic support is also pledged to the 1936 Program Committee that was given to Bridgeport Branch this year by the MONTHLY REVIEW.

The Abstract Section

PATRICK J. SHEEHAN, *Chairman, Program and Educational Committee*

Galvano, June 1935, page 15—An editorial commends the English platers on the excellence of their nickel plating, and attributes their superiority in large part to the close inspection and high standard set for work received from the polishing operations. C. T. THOMAS

The Use of Diesel Motors in Plating Shops, M. PICARD, *Galvano*, May 1935, page 22.—Discussion of use, analysis of costs, and sketches showing several lay-outs to illustrate the use of Diesel motors in plating work are given. C. T. THOMAS

Galvano, May 1935, page 17—The editor expresses much concern at the tendency to sacrifice quality of finish and thickness of deposit in the effort to reduce costs. He states that because of such practices the vogue for chromium plated work is waning rapidly, that the protective value of cadmium plating is being discredited, and that zinc plating has been subordinated to hot galvanizing. He refers also to a similar tendency in America. C. T. THOMAS

Barrel Plating Technique, E. J. DOBBS, *Metal Ind.* (London) **47,** 41 (1935). (Also to be printed in *Jour. Electrodepositors' Tech. Soc.*)—Three types of plating barrels are described, (a) with a perforated drum in stationary tank; (b) inclined barrel without diaphragm, and (c) an inclined barrel with a removable perforated inner container. It is necessary to use a high metal content in solutions for barrels, but too high conductivity should be avoided. For nickel on steel the pH (5.8) should be higher than for nickel on brass. The free cyanide of alkaline baths should be kept low. Thorough rinsing and rapid drying are necessary. Rubber is more satisfactory than celluloid, as it can be used in alkaline solution. W. BLUM

Electrolytic Tinning, MAX SCHLÖTTER, *Metallwirtschaft* **14,** 247 (1935).—It is claimed that by using tin baths containing certain "sulpho" acids (of which the composition is not stated), tin can be deposited satisfactorily at ordinary temperature, with current densities of 20 to 30 amp/ft^2 and even up to 150 amp/ft^2. A machine has been developed for tin plating wire at the rate of about 400 feet per minute with a thickness of about 0.00008 inch. Tin plated wire costs less than hot dipped wire and is softer and more ductile. Tin plated sheets may also be used for cans if the surface of the steel is smooth before plating. Through *C. A.* **29,** 4676 (1935). W. BLUM

The Influence of Additions to Nickel Baths; The Injurious Effect of Iron, E. RAUB MITT. *Forschungsinst. Probieramt Edelmetalle* **9,** 1 (1935). When iron is present in nickel baths (either from the anodes or salts) it makes the deposits finer-grained and may cause peeling. The author proposes addition

of organic compounds that will form complex compounds with the iron and eliminate its harmful effects. Citric acid and tartaric acid are most effective. If much iron is present, the pH should be kept below 4. Through *C. A.* **29**, 5023 (1935). W. BLUM

Laboratory Study of Protective Copper Plating in Case-Hardening, A. MAURAKH and V. MASLEMKOV, *Zavodzkaya* Lab. **2**, No. 2, 34-42 and No. 4, 26-33 (1935)—Best results are obtained by depositing the first copper layer from a cyanide bath at 2.5 to 3 amp/ft^2 for 10 minutes, followed by a deposit from an acid copper bath at 5 to 10 amp/ft^2. Through *C. A.* **29**, 5025 (1935). W. BLUM

Influence of Various Acid Radicals on Chromium Hardness. By DR R. J. PIERSOL. *Metal Cleaning and Finishing July* 1935. The article gives a brief resume of the use of various acid radicals in chromium deposition. A study of the reduction potential of these radical indicates their stability in a chromium solution. The values of the sulphate, chloride and fluoride radical are greater than the reduction potential of trivalent chromium. These radicals, therefore, are stable. An immediately preceding article gives factors, (current density, temperature, etc.) governing chromium hardness. It is possible that a plate will possess 100 times greater wear resistance, than another of equal thickness. EDWARD T. SHEEHAN

The Anodic Behavior of Tin in the Electrolysis of Sodium Stannate Solutions -Das Anodische Verhalten des Zinns bei der Elektrolyse in Natrium stannat-Lösung) By GÜNTHER HÄNSEL *Zeitschrift für Elektrochemie* - Vol **41** No. 6, 314-321,1935—The electro-deposition of tin from stannate solutions has been used extensively but is limited by the formation of stannite at the anodes which induces spongy deposits. The stannate condition may be maintained either (1) by oxidizing agents as hyrdogen peroxide, sodium peroxide, or ozone, or (2) anode solution in stannic state by polarization. A stannite-free electrolyte cannot be maintained when the anode dissolves in the di-valent state even when an excess of oxidizing agent is present.

The anode solution of tin in the stannate state is influenced by the solution composition. The tin content, caustic soda content and temperature strongly influence the state of dissolution. When the bath voltage is plotted against current density, a sudden rise occurs in the curve when stannic tin starts to form. This is coincident with a change in color of the anode from a blue-gray to a thin yellow coating of a stannous-stannic oxide.

The current density necessary to form the yellow coating varies from 10 amp/ft^2 with O free NaOH to 30 amperes/ft^2 with 10 gm/liter of free NaOH.

With increasing tin content, the required current density also increases. The required density varies from 10 amps/ft^2 with 10 g/l of tin to 40 amps/ft^2 with 25 g/l of tin.

The current density required increases with the temperature of the bath, but the electrolysis is done at higher temperatures (70°C) because of low cathode efficiencies at room temperature.

The yellow oxide on the anode necessary for stannate formation can be formed by subjecting the anode to 15 amp/ft^2 in a separate bath containing 6.5 oz/gal Na_2CO_3 and .4 oz/gal NaOH for a few minutes, or by slowly immersing the anodes in the plating bath with the current on, or lastly by subjecting the anodes to a current density of 30 amp/ft^2 in the plating bath itself and then operate at the usual current density.

The free caustic soda content of the tin bath should never drop below .5 oz/gal or else stannic acid will form on the anode with a corresponding drop in efficiency.

The bath voltage is a good criterion for proper anode dissolution. For proper performance it will be around 3.1 volts, whereas the voltage will be 4 or higher when the anodes are not dissolving satisfactorily.

WALTER R. MEYER

A New Process for the Avoidance of Unpleasant Smells and Tastes from Silver and Silver Plated Cutlery and Utensils. (Ein neues Verfahren zur Beseitigung unangenehm Geruchs und Geschmacks bei silvernen und versilberten Besteckteilen und Speisegeräten) *Deutsche Goldschmiede Zeitung* - Vol. **38**, No. 29, Issue 13, July 1935, Page 286-7—It has long been observed that silver tableware may possess a noticeable smell or taste due to traces of organic sulfur compounds, but little success had been found in solving the problem. Four methods may be used, namely: 1. Soaking in HCl - etching encountered. 2. Heating to 450-550°F., but oxidation and blistering of plate occurs. 3. Reduction by hydrogen - is slow and bothersome. 4. Surface oxidation by oxidizing agents - best method.

The per-oxidizing agents as perborate or perchlorate are effective.

The silver article need merely be immersed in a hot or cold solution of the oxidizing agent or be rubbed on with a mop using in addition chalk or other mild abrasives. A suitable mixture is — 1 part Whiting, 1 part Sodium Perborate, and 1 part Potassium Chlorate, using damp on a moist cloth. The addition of ammonia facilitates the oxide removal.

WALTER R. MEYER

MISCELLANEOUS ABSTRACTS

PHIL J. RITZENTHALER, *Section Editor*

1. Pickling. J. W. JENKINS. *Iron & Coal Trades Review*, Vol. **130**, Feb. 22, 1935, p. 339—Discussion before the Midland Metallurgical Societies of problems connected with pickling ferrous and non-ferrous metals. Rate of reaction depends on time, temperature and concentration of pickling acid. Mechanism of scale removal is the same, whether HCL or H_2SO_4. Acid acts through pores and cracks in scale. A series of experiments are summarized and show that within limits the control of temperature is more important than acid concentration. Maximum economy results from reducing spent liquor losses. Averages in 8 different plants were about 0.5 - 0.7 pounds of acid for

each 1000 sq. ft. of metal. Inhibitors should be used not merely to save acid but to insure against overpickling. Pickling of stainless steel is more difficult than ordinary steels. Best pickle is a nitric-hydrochloric mixture.

Phosphoric acid pickling is done quite a bit here and in England and is excellent previous to painting.

2. **Dry Cleaning Machine for Strip Steel.** *"Compressed Air Magazine* Vol. **39,** Oct. 1934 p. 4558 discusses process for removing oxide scale from hot rolled, annealed, or tempered steel sheets, bars, tubes, and wire by a dry cleaning process based on principle of sandblast. It differs in that metal is subjected to scouring and not to blasting, the medium employed being steel grit or shot carried in suspension by low pressure air. It replaces acid pickling which is destructive to material plant and equipment.

3. **Polishing and Buffing Operations in Electrical Manufacturing.** WALDO HUTCHINSON - *Electrical Manufacturing* Vol. **13,** Oct. 1934 pp. 26-28—Theoretical considerations and actual practice given for commercial polishing various metal plates.

4. **Black Chromium** - A. POLLACK — *Chemicker Zeitung* - Vol. **59,** Jan. 16, 1935 - p. 56—A Black Chromium deposit is obtained by using 8-9 times the normal current density, 800-1000 amperes square foot or more at a temperature not over 70° Fahrenheit. Solution should contain 33-55 ounces per gallon CrO_3 with addition of acetic or some other organic acid other than sulfuric acid. 11-14 volts is used, with cooling the solution to keep temperature down. Can be plated with or without nickel coat. Partly bright and partly black article can be made by bright chromium plating followed by black chromium plating. Useful for nameplates or signs. Black Chrome is very hard and is probably finely divided Chromium.

5. **Solubilities of Nickel Anodes** - EUGEN WERNER, *Die Metallborse* - Vol. **24,** Nov. 17, 1934 — Before war both cast and rolled anodes used. Now 99 plus anodes are used. Rate of solution of nickel is controlled by nickel solution. Anode become passive at higher current densities. Cast nickel anodes dissolve three times as fast as rolled anodes. Experiments are discussed.

6. **Formation of a Film and Protection of Metal by Painting.** H. WOLFF. *"Korrosion and Metallschutz* - Vol. **11,** Feb. 1935 - pp. 42-45 — Conditions under which a film of oil paint is formed which protects the underlying metals from corrosion are discussed. Although definite knowledge of this process is lacking it seems that film formation depends on drying conditions.

7. **Production Problems in Enameling Iron & Steel.** LE ROY ALLISON - *Iron Age* - Vol. **134** - Oct. 1934 pp. 21-27—Importance of basis metal in addition to enamel is discussed. Character of service has a primary bearing in selection of materials and enameling procedure. Enamels for outdoors must

resist rust and retain colors. Recent investigations on adherence of enamels show that during fusion alpha iron crystals develp in enamel. Cleaning is also a difficult problem.

8. Natural Patina or Copper - *Metals & Alloys* - Vol. 6, Feb. 1935 pp. 35-37 - Altho natural patinas on copper test as the sulfite it is suggested that basic carbonate is first formed. An electrolytro method of producing patina of basis carbonate in a 2 - 10% solution of sodium bicarbonate is described.

9. Accelerated Test for Coatings on Steel. *Steel* - Vol. **96,** Feb. 11, 1935, pp 47-49 — Machine known as weatherometer is used for giving coated panels accelerated tests equivalent to outside weather exposure of 1.5 - 2 years. Panels, placed in circular rack, are alternately doused with cold water, dried, heated and exposed to netra-violet rays once every 7½ minutes. This gives effect of continual change from hot to cold, sunshine to shadow with accompanying contraction and expansion.

10. Yellow Stain on Tin - "*Iron & Coal Trade Review*" Vol. **130,** Apr. 12, 1935 p. 630 — Yellow stain on tinplate is due to surface oxidation of tin in accordance with differential aeration principle. Heat at 140 degree C or by washing with methylated spirits.

11. Specifications for Standard Quality Silver Plated Tableware, "*Metal Industry*" Aug. 1935 - pp. 283-289—Present yardstick for quality in plated tableware is the total weight of silver deposit per gross of spoons. This is not true quality, as this depends on length of service given under average conditions. True measure of quality is amount of silver deposit on work plus thickness of silver at points of greatest wear. Wear points are back of handles, bowl of spoon, cutting edges of knives. Article gives British Tableware codes and American codes as set up by the N. I. R. A. It also proposes new standards for use in America. Proposes minimum thickness of 0.0018 on back of bowl of spoon, as thickness on back determines life. Method is given for measuring silver thickness, which consists in filing through deposit till base metal is exposed and measuring size of flat spot. A Chart is given for this purpose.

12. Ford uses New Rustproofing Process.—An alternating current process for rustproofing steel lamp shells is used, known as Grandodizing. Solution consists of zinc phosphate and phosphoric acid. Both is kept at 155 degrees F and alternating current of 20 volts and from 35-50 amperes per sq. foot run to work. Articles treated first with rag dampened with low grade gasoline, then into bath for 4½ minutes, then to hot water rinse, and finally to paint booth. Parts must stand 300 hours salt spray, although some run as high as 1000 hours. Process is said to be best suited for their work, as requires a minimum of space and provides surface ready for painting as it comes from process.

Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTRO-PLATERS' SOCIETY

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch was held August 10, at the Atlantic Hotel. President F. Herbst presiding and all other officers present.

Mr. F. J. Hanlon installed our new sergeant at arms M. J. Mintz and instructed him about the duties of this office.

Mr. W. J. Erskine was elected an active member of Chicago Branch.

A letter from Mr. W. Fraine, Secretary-Treasurer of the research committee with a check enclosed returning the loan made by Chicago Branch to the research committee in 1932 received and the Officers and members of Chicago Branch wish to thank the research committee for the return of this loan and are very pleased to learn that the research is able to again make the progress that it should. As this research work is very necessary as well as interesting.

A card from the Milwaukee branch regarding their annual picnic read and placed on file.

The librarian O. E. Servis found the following questions in the question box.

No. 1. *What causes black streaks in silver plating?*

Answer. Many suggestions offered but thought the main cause was lack of silver, or lack of cyanide.

No. 2. *What causes copper to turn black if plated over tin, the copper deposit is about* .0005 *and is lacquered?*

Answer. Sulphur in the lacquer solvent, and atmospheric conditions before the application of the lacquer.

No. 3. What is the best formula for *cyanide zinc solution to be used in plating barrels?*

Answer. 6 oz. cyanide, 4 oz. zinc cyanide, about 4 oz. caustic soda, room temp.

No. 4. *What causes certain pieces of work to plate gray in chrome, other parts on the same rack are nice and bright?*

Answer. Many suggestions offered, but the main causes were poor Nickel buffing, not the same temperature thru the solution, poor cleaning, and poor electric contacts.

No. 5. *When making up a nickel solution using double salts, is any element in the salt lost if boiled to dissolve?*

Answer. No.

No. 6. *What is wrong when polished cadmium tarnished over night?*

Answer. The cyanide has not been rinsed off good enough, the ammonia in the solution could cause this condition. Some greases in some buffing compounds will cause this condition.

No. 7. *How can hypo sulphite put in a brass solution by mistake be removed?*

Answer. Hydrogren peroxide can be used to break up the hypo sulphite.

Elected. W. J. Erskine, 751 John St., Rockford, Ill., Active.

Suspended. M. Ludwig, 11304 Wallace St., Chicago, Ill.

J. W. HANLON, *Secretary*

CLEVELAND BRANCH

The regular monthly meeting of the Cleveland Branch of the American Electro-Platers Society was held at Hotel Carter, Saturday, August 3,1935. The meeting was called to order by our

president, Mr. W.D.Scott, at 8:15 p.m. The minutes of the June meeting were approved as read.

An application for membership by Mr. Edward Friedle of 308 Darrow Road, Akron, Ohio, employed by the Firestone Steel Products Company, was turned over to our Board of Managers. The election of Dr. Drayer of Akron, Ohio was approved. All bills were ordered paid.

The report from our National Secretary, Mr. Steen Thompson, was read, approved, and ordered filed. This report showed that we are in a much better financial condition than we were a year ago. Mr. Thompson then read letters and answers to Mr. Cotton, in regards to the loss of his valise and baggage which he lost in Cleveland. The Cleveland Branch is very sorry to hear of this loss.

The picnic committee reported that the picnic this year would be held Saturday August 10th, at The Duke of York Tavern, and would join in with the Master Platers Institute and supply men of Cleveland, to have just one grand time for all those connected with the plating industry. Delegates to the 1935 convention reported that it was a grand success.

A new amendment to the by-laws allows assistant foremen to the society if endorsed by the foreman under whom he is employed. The 1936 convention is to be held in Cleveland, Ohio. Messrs. Thompson, Singler, and Nacthman reported on Hotels and exhibition spaces. Motion made by Mr. Singler and seconded that the 1936 Convention dates be June 9 to 12 inclusive. Voted on and carried.

Our president Mr. W. D. Scott then appointed the following Chairman for the Convention:

General Chairman, Mr. H. J. Ter Doest; *Education*, Mr. John S. Nachtman; *Advertising*, Mr. E. Steen Thompson; *Hotels*, Mr. J. C. Singler; *Registration*, Mr. William O'Berg; *Secretary and Treasurer*, Mr. William O'Berg.

A motion was made by Mr. Nachtman and seconded that the committee on Hotels and exhibition space be given full power to act on places selected. Voted on and carried. There being no further business the meeting adjourned.

W. E. O'Berg, *Sec. and Treas.*

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BRIDGEPORT BRANCH

At the regular August Meeting of the Bridgeport Branch about thirty members were present in spite of the heat. A motion that the Branch hold an outing for members and their wives with the Branch paying the expenses was met with approval and the event is expected to take place in the middle of September. Friends and guests will

be welcome although the branch will not pay for their admission. The outing is in capable hands with Bill Flaherty, Joe Sterling, George Wagstaff, Bill Stratton and Fred Lancaster on the committee in charge. It was voted at this meeting to pay the Secretary of the Branch Fifty dollars per year with dues.

While the Branch was still in the mood for spending money, Walter Meyer, our Librarian suggested that the Branch subscribe to the Metal Industry of New York, The Metal Industry of London and the Journal of the Electrodepositors Society in England. The Librarian will receive the copies of the magazines and bring them to the meetings where they will be available to the members. Mr. Meyer has been conducting a round table discussion after the adjournment of the regular business meeting. This month the members discussed tin plating, bright nickel solutions and other topics of general interest. We feel that this informal educational session with a capable man like Walter Meyer to lead discussion is an extremely valuable part of our monthly meeting. A question box will be started in the fall.

Three of our new members — Dr. Henry L. Kellner, Roland Doucette and John Charleson were present at this meeting.

CHAS. COSTELLO, *Sec'y.*

PHILADELPHIA BRANCH

With George Gehling in harness again as Secretary-Treasurer we can be assured of a year of activity.

Mr. Warren Reynolds has accepted chairmanship of the Banquet Committee. "Enough said."

D. R. Robson has been appointed Editor of the Quaker City Reminder."

Robert Jackson, Jr., is chairman of the Education Committee. He is a prodigy of the Jules Mastbaum School, "You Know."

Look for the Quaker City Reminder - it has a story to tell.

AL. HIRSCH

We wish to call to the attention of our various members several innovations which our President, Mr. Hirsch has outlined for us for practice during the ensuing year.

First, besides the regular monthly speaker, a full series of short lectures covering Practical Electrochemical Principles as applied to our own industry and use will be demonstrated and discussed. These lectures will be given preceding the regular business meeting and guest speaker. They will begin at 7.30 and be rather short so as to not make the meeting any longer than formerly. It is the intention of Mr. Hirsch, who will conduct these lectures to have each principle demonstrated with a practical working model or the apparatus involved. Their titles will be as follows:—

1—Potentiometric determination of pH. Demonstrated with a home-made potentiometer that any plater could build.

2—Faraday's Laws. Demonstrated with a modified Richard's Silver Coulometer.

3—Cathode and anode current efficiency. A copper and coulometer of simple construction will be used in this case.

4—Electrode potentials and difference in potential. Demonstrated.

5—Measurement of polarization. Demonstrated with a self constructed Haring Cell.

6—Measurement of resistivity of solutions. Haring Cell.

7—Ohms Law. A piece of apparatus, made possible by the generosity of

the Electroplater's Class, Mastbaum School.

The second innovation is the offer of prizes for the three best papers written by platers of your own branch which are selected to be read at the Banquet Meeting in November. Since it is your own Branch and your meeting, shouldn't you take a part in the meeting? Many of the problems in your shop which you have found a solution for, are the difficulties of many of your friends. Here is a fine opportunity to get together and have a good round table discussion. Let us all get started on our papers, and give the judges a lot of trouble in choosing three most interesting papers.

Let us start the new season off right by having a full house for the September meeting. Every meeting will be an "Open House" and we want you and all your friends and in return we will try to give you the best meetings which you have ever attended. Don't forget the Evening Class at The Mastbaum School, which will be starting in September and here is a fine opportunity for you and the men in your department to have added information.

Next meeting of the Philadelphia Branch on Friday, September 20th, at the Harrison Laboratory.

Registration for the Platers Class at the Mastbaum Vocational School, Monday, September 16th. Don't forget these dates.

DEL. R. ROBSON.

MILWAUKEE BRANCH

The Milwaukee Branch A.E.S. held their annual picnic August 25, the day being a perfect one. The attendance was excellent with close to 250 people present, who were out to enjoy themselves and certainly did. The games and races with the drawings for door prizes net about 52 extra happy people. The prizes were donated by the following Companies: Mass. & Waldstein Co., Matchless Metal Polish Co., Globe Union Mfg. Co., Advance Polishing Wheel Co., Crown Rheostat & Supply Co., Paper Makers Chemical Co., Wyandotte Co., National Tinsel Mfg. Co., Graselli Chemical Co., Donald Sales & Supply Co., S. K. Williams Co., Hanson, Van-Winkle, Munning Co., H. C. Miller Co., Briggs-Stratton Co., Marvel Service Station, Matuscka Co., Fulton Co., Snap On Tools Co., Garton Toy Co., Clum Mfg. Co.

We believe our hospitality is becoming better known as the years go by. The out-of-town attendance was very good, Chicago leading the parade with close to 30 guests. Out of town guests were as follows: Oscar Servis family, Frank Hanlon family, Jim Hanlon family, Charles Barry family, Steinberg family, Ruby Hozucha family, Jim Selch family, Longfield family, Jake Hay family, McCabe family, Rhinelander family, H. A. Gilbertson family, Mr. Harold Smallman, Henricks family.

Did you see our own Dan Wittig, the best dressed Electro-Chemist on the lot sporting that new palm beach and 10c cee-gar. Our President, Bob Steuernagel had a bum right arm, but that didn't stop him from hoisting them (not dumbells). The Maestro himself, Pat Sheehan can still show some of the boys how to play ball. Paul Krause, Jack Geisman, Frank Marx, our picnic committee certainly did a real job, giving next year's committee something to think about.

ROMAN C. BINDER, *Secy.-Treas.*

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Membership Turnover

For the Period Ending August 18, 1935

ELECTED

Eugene J. Zurback Jr., 1833 N. Newkirk St., Philadelphia, Pa.
Active, Philadelphia Branch

Mr. William J. Erskine, 751 John St., Rockford, Ill.
Active, Chicago Branch

Mr. Clifford Drayer, 1346 Kentucky Ave., Akron, Ohio
Active, Cleveland Branch

Mr. William Rice, 34 Hillside Ave., New York City
Active, New York Branch

Mr. Harold Peterson, 568 Oakwood Ave., Toledo, Ohio
Active, Toledo Branch

Edward E. Andrew, 182 Fairlawn Ave., Waterbury, Conn.
Bridgeport Branch

John D. O'Connell, 1193 Mechanic St., Fitchburg, Mass.
Bridgeport Branch

Roland J. Doucette, 160 Alder St., Waterbury, Conn.
Bridgeport Branch

John Edgar Charleson, Yale and Towne Mfg. Co. Stamford, Conn.
Bridgeport Branch

Henry L. Kellner, 16 Cherry Ave., Waterbury, Conn.
Bridgeport Branch

APPLICATIONS

Mr. Edward Friedle, 308 Darrow Road, Akron, Ohio
Associate, Cleveland Branch

John L. Nelson, 1617 North St., Philadelphia, Pa.
Active, Philadelphia Branch

REINSTATEMENTS

Mr. Jacob Reingold, 673 Saratoga Ave., Brooklyn, N. Y.
New York Branch

W. W. Bannon, 613 Park Ave., Lancaster, Pa.
Active, Philadelphia Branch

RESIGNED

Wm. Kusterer, 442 Summit St., Bridgeport, Conn.
Bridgeport Branch

TRANSFERRED

G. Byron Hogaboom, Philadelphia to Newark Branch
George T. Turner, Philadelphia to Baltimore-Washington Branch

SUSPENDED

Chas. Trombetta, 4 Park Street, Stamford, Conn.
Bridgeport Branch

M. Ludwig, 11304 Wallace St., Chicago, Ill.
Chicago Branch

C. M. Moore, 337 S. Pine St., York, Pa.
Philadelphia Branch

E. T. Homan, 1118 N. 28th St., Camden, N. J.
Philadelphia Branch

W. J. Bell, 707 N. 35th St., Philadelphia, Pa.
Philadelphia Branch

DEATH

Dayton Lasher, 267 Sylvan Ave., Waterbury, Conn.
Bridgeport Branch

ANALYTICAL SET

To determine the thickness of cadmium and zinc coatings Kocour Company offer a testing set. It is simple, rapid and economical in operation, compactly contained in dust proof cabinet and moderate in price.

NEWARK BRANCH
Annual Outing *and* Clambake
SATURDAY, SEPTEMBER 21
OLD CIDER MILL GROVE
UNION - NEW JERSEY

NOTE — Newark Branch has established a wide reputation for the excellent and thorough "enjoyability" of this annual event. If you have ever attended one you will go. If not — you better begin with this one.